



MODIS/VIIRS L1B Product Status

MODIS Characterization Support Team, NASA GSFC
VIIRS Characterization Support Team, NASA GSFC

(presented by Xu Geng)



*MODIS/VIIRS Calibration Workshop
(May 1, 2023)*





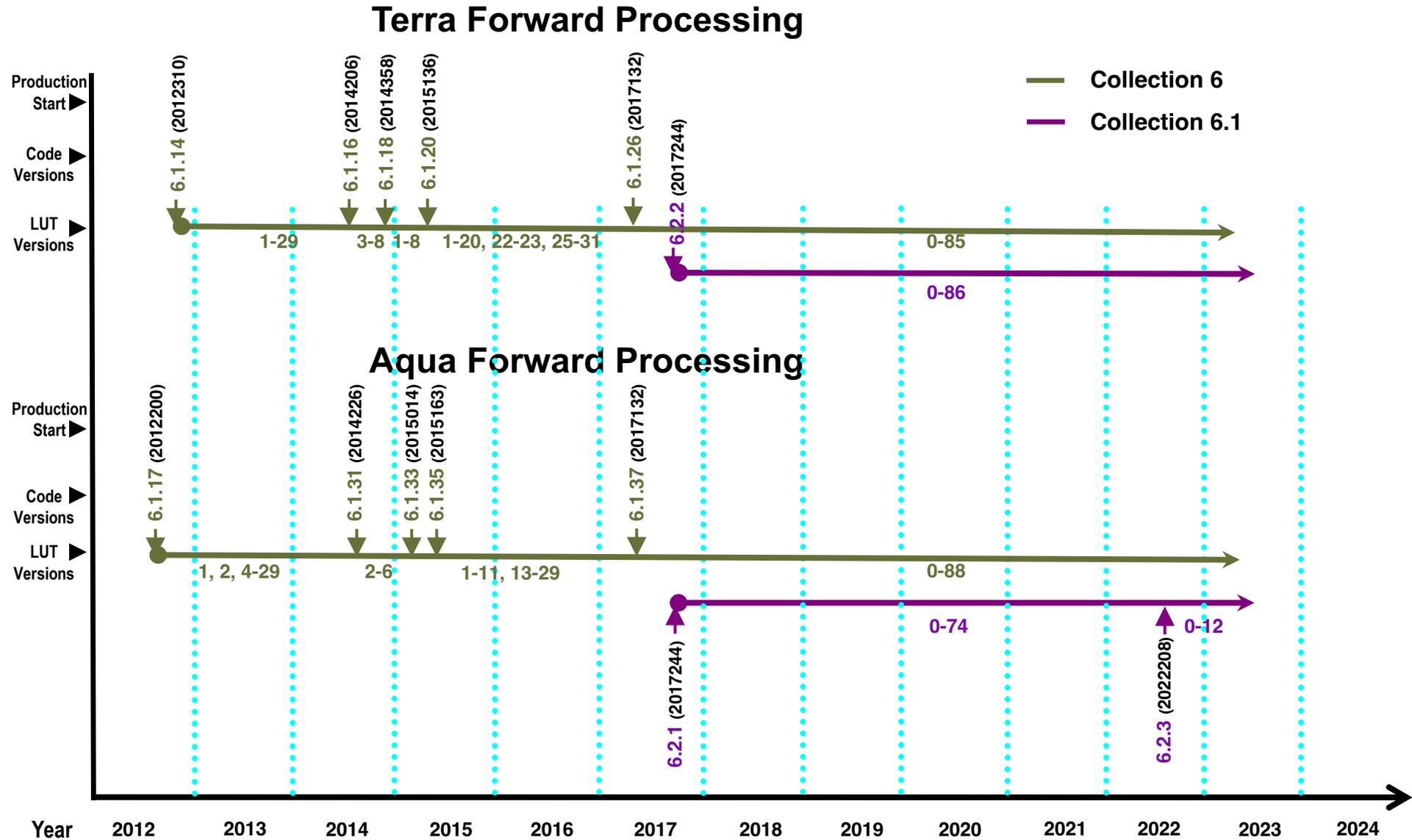
MODIS L1B Data Product Status



- Versions in operation
 - Collection 6.1: Terra V6.2.2; Aqua V6.2.3
- Collection 6 discontinued in April 2023
- Aqua C6.1 update to V6.2.3 in forward processing to address the increasing PV LWIR crosstalk effect after the safe-mode in March 2022
 - The forward processing started on 7/27/2022
 - The reprocessing between the safe mode and 7/27/2022 was completed in Nov. 2022
- Terra MODIS C6.1 partial reprocess after recovery from anomaly
 - CP/FP Reset – March 2022 (2022075 onwards)
 - CEMs – Oct 2022 (2022296.2200 onwards)
- C7 L1B code/LUT are undergoing science testing
 - 1st set of code/LUT delivered in March 2021 with subsequent improvements.
 - C7 L1B reprocess is expected in Spring of 2024
- Started merging C7 RSB calibration algorithm to C6.1 forward production (03/2023)
 - Phase-in period: Aqua – 3 months; Terra – 10+ months



MODIS L1B Production Timeline (C6 & C6.1)





C6 and C6.1 L1B LUT Updates



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Terra C6	5	14	17	18	14	14	14	15	14	14	18	2
Terra C6.1						10	13	13	16	13	18	4
Terra OBPG		1	15	17	3							
Aqua C6	7	11	15	16	16	13	16	14	14	16	17	2
Aqua C6.1						6	16	14	13	16	18	4
Aqua (OBPG)	1	9	13	13	13	13					6*	4*
Total	13	35	60	64	46	56	59	56	57	59	77	16

* Upon OBPG's request without including the PV LWIR xtalk correction



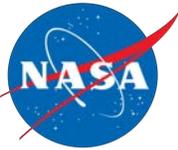
Collection 7 L1B Major Changes



- Implemented the crosstalk correction algorithm to all detectors in PV LWIR bands and select detectors in MWIR bands.
- Implemented edge correction to address the absence of sending band data for pixels at the scan edges in PC, PV LWIR and MWIR xtalk corrections.
- Various Calibration algorithm improvements reflected in C7 LUT
- Integrated with C7 API developed by LDOPE to facilitate the transition to NetCDF4/HDF5
- The technical memos summarizing the code changes and algorithm enhancements can be found from,
 - <https://mcst.gsfc.nasa.gov/content/collection-7>



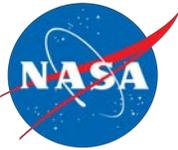
VIIRS L1B Data Product Status



- VIIRS L1 software/LUT and data design are developed under NASA EDOS/SIPS.
 - L1 software maintained by NASA Ocean group
 - VCST provide LUT updates as well as software development support
- S-NPP L1B C2 is ongoing at Land SIPS – LSIPS Archive Set 5200 using L1B software V3.1
- S-NPP L1B C1 is ongoing at Land SIPS for Level-2 downstream process. LSIPS Archive Set 5000 (using SDR Mx software and LUT) and 5110 (using L1B software V2.0).
- NOAA-20 (JPSS-1) C2.1 is ongoing – LSIPS Archive SET 5201 using L1B software V3.1.
- NOAA-21 (JPSS-2) L1B is ongoing – LSIPS Archive SET 4014 (not publicly available) using L1B software V3.2 (released in Nov 2022) and VCST LUT. On-orbit L1B LUTs have been delivered to SIPS for ongoing Cal/Val.
- Future Improvements (ongoing work):
 - Roll over algorithm in calibration and quality flag in L1B.
 - Uncertainty algorithm to be applied in L1B.
 - Move the hard-coded dynamic range parameters to a LUT
 - Change the DeltaC LUT from static to dynamic



VIIRS S-NPP L1B Products (SIPS Support)



- NASA SIPS L1B Products for S-NPP (6-min granule in NetCDF format)
 - Calibrated data files are reduced from 22,000 SDRs to 720 L1Bs daily.
 - First L1B software V1.1.0 was released in Jan 2016.
 - Software V2.0.0 was released in Oct 2016.
 - Software V3.0.0 was released in August 2018 for both S-NPP and NOAA-20 (JPSS-1).
 - Software V3.1.0 was released in October 2020.

Collection	Code Base	# of LUTs	Delivery Time	Note
C1	L1B V1.1.0	20	2016.02 - 2017.09	Redesigned L1B software, LUTs, and data format using L1A data input.
	L1B V2.0.0	62	2016.08 - 2023.03	* Improved L1B software functions and algorithms. (LSIPS data AS-5110 in NetCDF) * Latest LUT V2.0.0.62 on February 24, 2023.
	L1B V3.0.0-rc	24	2018.01 - 2020.07	Run for both NPP and J1. Add different RTA encoder start value for J1. Modify J1 DNB GEO over extended mode. Introduce M11 process at Ops_Night. Improve M13 radiometric resolution. Add moon phase and illumination for DNB pixel.
C2	L1B V3.0.0	5	2019.11 - 2020.04	* LUT V3.0.0.x: Lunar 6-year data applied to RSB calibration adjustment. * Land SIPS L1B for validation, not officially released.
	L1B V3.0.0	4	2020.05 - 2020.09	* LUT V3.0.1.x: Correct early mission SD Cal on M1/M3 using lunar calibration data. * Land SIPS L1B for validation, not officially released.
C2	L1B V3.1.0	20	2020.10 - 2023.03	* LUT V3.1.0.3 - first LUT using L1B software V3.1.0 officially. LSIPS data AS-5200. * Latest LUT V3.1.0.20 on February 24, 2023.



VIIRS SDR Products (S-NPP only) (SIPS Support)

- Land SIPS SDR process using modified IDPS Code with VCST LUTs (C1.0 and C1.1)
 - Modified IDPS SDR/EDR codes Mx based version with LUTs input from VCST.
 - Total of 102 sets of LUTs for RSB and DNB have been delivered to Land SIPS for data reprocessing and SDR/EDR assessments in Collections 1.0 and 1.1.

Collection	Code Base	# of LUTs	Delivery Time	Improvements
C1.0	Mx6.3	5	2012.10 - 2013.01	Smoothed functions for SD degradation H-factor and calibration coefficients F-factor.
	Mx6.4	5	2013.04 - 2013.11	Updated SD/SDSM screen transmission, SD BRDF, RTA mirrors degradation model, and modulated RSRs.
C1.1	Mx7.2	25	2013.12 - 2016.02	Improved time-dependent modulated RSR, DNB stray light correction, H & F fitting functions. (LSIPS data AS3110)
	Mx8.11	67	2016.03 - 2023.03	Improved Quality Flags, introduced DNB gain ratio and LGS LUTs, fixed solar/lunar vectors, with RSBAutoCal option. (LSIPS data AS-5000 in H5 format) * Latest LUT V8.11.0.67 on February 24, 2023.



VIIRS N20 (JPSS1) L1B Products (SIPS Support)



- NASA SIPS L1B Products for NOAA-20 (JPSS-1)
 - L1B software V3.0.0 was released in August 2018 with full S-NPP and JPSS-1 support.
 - V3.0.0 LUTs updates are being released by VCST with 2 months forward prediction.
 - Land SIPS started JPSS-1 mission reprocessing Collection 2 using V3.0.0 software in June 2019 and completed in September 2019.
 - L1B software V3.1.0 was released in October 2020 for Collection 2.1 reprocessing; forward process ongoing.

Collection	Code Base	# of LUTs	Delivery Time	Note
C1	L1B V3.0.0-rc	8	2018.06 - 2019.05	Run for both NPP and J1. Add different RTA encoder start value for J1. Modify J1 DNB GEO over extended mode. Introduce M11 process at Ops_Night. Improve M13 radiometric resolution. Add moon phase and illumination for DNB pixel.
C2	L1B V3.0.0	8	2019.06 - 2020.06	* LUT V3.0.0.x Bug fixed in H-factor impacting F-factor for RSB/DNB; mission LUT regenerated. (LSIPS AS-5200)
	L1B V3.0.0	2	2020.07 - 2020.09	* LUT V3.1.0.x Updated pre-launch RVS of all bands (mission LUT). (LSIPS AS-5200)
C2.1	L1B V3.1.0	7	2020.10 - 2023.03	* LUT V3.1.0.3 - first LUT for software V3.1.0. (LSIPS AS-5201). * LUT V3.1.1.1 - first LUT to use N20 Lunar data for RSB calibration. * Latest LUT V3.1.1.4 on February 2, 2023.



VIIRS N21 (JPSS2) L1B Products (SIPS Support)



- NASA SIPS L1B for JPSS-2 VIIRS
 - L1B software V3.2.3 was released in November 2022 with JPSS-2 support available at Ocean group GIT for J2 VIIRS processing .
 - J2 pre-launch calibration look-up-tables LUT (NetCDF format) was delivered to NASA SIPS in October 2022 for systems testing and integration.
 - The first J2 on-orbit L1B LUT was delivered in December 2022 prior to nadir aperture door opening.
 - LUT V3.2.3.5 contains mission update and can be used for reprocessing
 - VCST continues updating L1B LUTs derived from on-board calibrators observation and analysis.

Collection	Code Base	# of LUTs	Delivery Time	Note
Pre-Launch	L1B V3.2.0-rc	1	2022.10	L1B software release candidate version V3.2.0, at Ocean SIPS GIT, run for J2 L1A data from S/C JCT testing. * First J2 pre-launch LUT "J2_PreLaunch_20221013" was delivered to SIPS on Oct 28, 2022, for L1B functional test.
On-Orbit	L1B V3.2.3	6	2022.12 - 2023.04	L1B software V3.2.3 release on Nov 28, 2022, support for J2 (NOAA-21) platform. * First J2 on-orbit LUT V3.2.3.1 was delivered to SIPS on Dec 2, 2022, for RSB VisNIR F-Predicted table update. * LUT V3.2.3.5 on April 19, 2023, for mission update (LSIPS AS-4014 hidden)



Summary



- Terra and Aqua MODIS continue to operate normally
 - MODIS C6 discontinued in April 2023, C6.1 is the primary product, and C7 is undergoing science testing
 - Gradually phase-in C7 RSB calibration algorithms to C6.1 forward production
- SNPP, N20 (J1), and N21(J2) VIIRS also continue to operate normally
 - C2 (SNPP) and C2.1 (N20) are the primary products.
- JPSS-2 VIIRS on-orbit LUTs update undergoing
- Dedicated efforts have been made by the MCST and VCST
 - Characterize on-orbit sensor performance
 - Evaluate and address issues identified, including cross-sensor calibration differences (critical to consistent and long-term data records)
 - Support science data production and reprocessing